Nanoparticles produced by inert gas aggregation system were deposited on the Silicon
Nitride (Si3N4) substrates under good vacuum conditions. Nanoparticles coalesced and
agglomerated rapidly as they were deposited on the substrate. A peculiar voltage
dependent non-ohmic conductance behavior was observed for certain film morphologies,
whereas the resultant morphology of these films was found to be dependent upon the
initial size of particles, deposition rate and the ambient conditions of the films. The
coalescence enhanced, due to large deposition rate or low oxidation rate, played a vital
role in the formation of metallic films in large islands separated by cracks and voids
suitable for conductance switching behavior. Simulations were performed to mimic and
understand the morphology of these experimentally produced films. A new improved
model is presented in which coalescence was restricted by deposition rate and maximum
size limit of the particles formed by coalescence. Initial and cut-off sizes of particles along
with a new parameter which is directly proportional to the deposition rate were used for
our simulations. By varying these parameters, a range of simulated morphologies were
generated for a successful comparison with experimental results and for the indirect
calculation of the oxidation time after which the particles stop coalescing.